Work Plan

Monitored Natural Attenuation (MNA) Pilot Study

Old Mill Superfund Site
Rock Creek, Ohio

September 2006

BROWN AND CALDWELL

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1.0 INTRODUCTION

This Work Plan serves as an addendum to the existing Long-Term Monitoring Program (LTMP) Work Plan (Brown and Caldwell, 2001) and describes the Monitored Natural Attenuation (MNA) Pilot Study planned for the Old Mill Superfund Site (Site). The purpose of the Pilot Study is to further evaluate whether MNA, or enhanced MNA, is a viable alternative to the existing groundwater remediation system that has been operating at the Site since 1989, and could facilitate returning the Site to productive community use in a shorter timeframe. The MNA Pilot Study has been designed to last four years. This Work Plan has been developed for use by the Supervising Contractor (currently Brown and Caldwell (BC) and has been prepared in accordance with the initial MNA evaluation summarized in the revised MNA Technical Memorandum (Brown and Caldwell, 2006). The revised MNA Technical Memorandum incorporates responses to Ohio Environmental Protection Agency's comment letters dated January 26, 2004 and June 14, 2004.

1.1 Site Location and Description

This section of the MNA Pilot Study Work Plan presents a brief discussion of the Site location and a summary of the long-term remedial action for groundwater currently in place.

1.1.1 Site Location

The Old Mill Superfund Site is located in the village of Rock Creek, Ohio in Ashtabula County. The Site consists of two parcels of land: the 3-acre Henfield Parcel and the 10-acre Kraus Parcel (see Figure 1). The two parcels are separated by Station Street. The area is a rural setting with the closest residences about 75 feet from the Site boundary. Land use in the vicinity of the Site is a mixture of residential, agricultural, and commercial/light industrial developments.

1.1.2 Site Description

The general site conditions are described in the following paragraphs.

Geologic/Hydrogeologic Setting

CH2M HILL, under contract to USEPA, conducted a Remedial Investigation (RI) for the Site in 1984 and 1985 (CH2M HILL, 1984, 1985). Their RI report and addendum includes a comprehensive description of regional and local geology and hydrogeology. A summary of local conditions, derived largely from CH2M HILL's reports, is included in the following paragraphs. The reader is referred to the RI report and addendum for a more complete description.

The Site is underlain by approximately 10 feet of silts/clays (Hiram Till) resting atop Devonian shale bedrock (the Ohio Shale). The upper one to three feet of the shale is weathered. The shallow water-bearing zone is within the silts/clays and upper weathered shale, while the deeper water-bearing zone is within the competent shale bedrock. The shallow water table is generally encountered at depths of approximately seven feet below ground surface. Shallow groundwater generally flows to the west beneath the Henfield Parcel and to the northwest beneath the Kraus Parcel. Shallow groundwater likely discharges to the Grand River, located approximately 1.5 miles west of the Site, or its eastern tributaries (including Rock Creek). A typical shallow groundwater potentiometric surface is illustrated on Figure 1. The thickness of the shallow water-bearing zone varies in response to wet and dry seasons and precipitation events, and therefore, is not considered to represent a regional aquifer. Based on available hydraulic conductivity data, observed groundwater gradients, and estimated effective porosity, shallow horizontal groundwater velocity beneath the Site is likely on the order of 10 to 100 feet per year, with the upper weathered shale likely contributing to the higher velocities.

A downward groundwater gradient from the shallow water-bearing zone to the competent bedrock exists throughout much of the Site, although portions of the Site have displayed an upward gradient. However, as the RI report states: *"shallow groundwater is migrating through the unconsolidated deposits and weathered bedrock. There is relatively little vertical flow from the unconsolidated*

deposits and weathered bedrock into the competent bedrock even though downward vertical gradients are generally present. The ER (electrical resistivity) survey results discussed above indicate less transmissive bedrock below the weathered surface".

Groundwater Collection and Treatment Systems

The Site and existing remedial activities are currently operated under the supervision of BC and its on-site contractor, Lord Corporation. Site remediation activities include groundwater collection and on-site treatment and discharge to a surface water ditch. Contaminated groundwater is extracted from the shallow water-bearing zone via interceptor trenches and from the deeper water-bearing zone via wells. The extracted groundwater is pumped to the treatment building located on the southern edge of the Henfield Parcel. The groundwater collection and treatment system flow rate is typically less than 10 gallons-per-minute, and is designed to maintain hydraulic control (i.e., containment and capture) of affected groundwater. The treatment system is designed to remove volatile and semi-volatile organic compounds via air stripping and carbon adsorption. The treated effluent is then discharged by gravity to a surface water drainage ditch that ultimately flows into Rock Creek.

Locations of these wells, sumps, trenches, and the treatment system are shown on Figure 1. The groundwater collection and treatment systems are described in further detail below.

Groundwater Collection/Extraction

Each of the two parcels comprising the Site has separate groundwater collection/extraction networks designed to capture and contain contaminated groundwater. Compliance monitoring and data evaluation is performed regularly to assess the progress of the remedial action. These tasks include quarterly collection of groundwater elevation data to delineate zones of hydraulic containment associated with the extraction systems, and annual collection of groundwater data and quarterly collection of treatment plant influent/effluent data to evaluate trends in contaminant concentrations and the effectiveness of the treatment system.

The Henfield Parcel groundwater collection network consists of two trenches in the shallow water-bearing zone, which drain to the Martin Sump and the Henfield Sump, and one extraction well (Henfield Well), which pumps from the deeper water-bearing zone. The

system is monitored at 12 compliance monitoring wells, 7 of which (RWSH-1, RWSH-2, RWSH-3, RWSH-4, RWSH-5, RWSH-6. RWSH-7) are screened in the shallow water-bearing zone and 5 of which (RWDH-1, RWDH-2, RWDH-3, RWDH-4, RWSH-5) are screened in the deeper water-bearing zone. The Martin Sump, the Henfield Sump, and the Henfield Well have also been sampled on a regular basis.

The Kraus Parcel groundwater collection network consists of three trenches in the shallow water-bearing zone and two extraction wells installed in the deeper water-bearing zone. The first trench, which is drained by the Kraus Sump, and the Kraus Well were components of the original remedial design for the Site. The second trench, which is drained by the Kraus Modified Sump, and the Kraus Modified Well, were installed in response to discovery of an area of contaminated soil and groundwater during soil excavation while implementing the Site remedy. The third trench, which is drained by the Kraus Additional Sump, was installed in 1994 in response to detections of groundwater constituents in monitoring wells located downgradient of the other two collection systems.

The Kraus groundwater collection system is monitored by 21 monitoring wells and 8 piezometers. Wells RWSK-1, RWSK-2, RWSK-3, RWSK-4, RWSK-5, and RWSK-13, all completed in the shallow water-bearing zone, are located in various upgradient, downgradient, and sidegradient positions to the first trench and the Kraus Sump. Piezometers P-1, P-2, P-5, and P-9 are also completed in the shallow water-bearing zone and are located in various downgradient and sidegradient positions to the first trench and the Kraus Sump. Wells RWDK-1, RWDK-2, RWDK-3, RWDK-4, and RWDK-5 are completed in the deeper water-bearing zone in similar upgradient, downgradient, and sidegradient positions to the Kraus Well and are paired with the shallow monitoring wells of corresponding number. Shallow water-bearing zone monitoring wells RWSK-6, RWSK-7, and RWSK-8, respective paired deep water-bearing zone monitoring wells RWDK-6, RWDK-7, and RWDK-8, and shallow water-bearing zone piezometers P-3, P-4, P-6, and P-8 are located in generally downgradient and sidegradient positions to the second trench, the Kraus Modified Sump, and the Kraus Modified Well. Four shallow monitoring wells, RWSK-9, RWSK-10, RWSK-11, and RWSK-12 are located downgradient of the third trench and the Kraus Additional Sump.

Locations of the monitoring wells and peizometers on the Henfield and Kraus Parcels are shown on Figure 1.

Groundwater Treatment System

Groundwater is extracted from a total of five collection trenches and three extraction wells from the two parcels comprising the Site. Each trench includes an adjacent sump into which groundwater flows. Each sump is equipped with a submersible centrifugal pump with which the groundwater is transferred. Similarly, each well is equipped with a submersible pump. Each pump has a design capacity of three gallons per minute (3 gpm), though during normal operating conditions each well or trench is expected to produce approximately one gallon per minute (1 gpm). A hand control valve located in each well vault is used to regulate the flow rate from each sump or well. The pumps are designed to be activated on and off by respective high and low level switches located in each well and sump. The discharge from each of these submersible pumps, P-101 to P-106 (see Figure 1), is pumped through stainless steel underground pipes which join in a 2-inch diameter common underground manifold for transfer to the 2,000-gallon feed tank located in the treatment building.

From the feed tank, the treatment system consists of the following components:

- Filtration via element filter to remove particulates,
- Air stripping via a packed tower with blower,
- Polishing via granular activated carbon, and
- Discharge of treated effluent to a surface drainage ditch.

The treatment system was designed for unattended operation, with periodic checks by an operator. The equipment instrumentation (i.e., interlocks) prevents mechanical damage by shutting down the equipment in cases of low or no-flow conditions. Spills or leaks which may occur are contained in a floor sump (with an automatic level-controlled pump) located inside the treatment building which prevents untreated water from being discharged in the event of a mechanical or operational upset. The floor sump discharge is directed back to the

feed tank. An auto-dialer is in line that detects potential system problems and automatically calls the designated responder(s) to alert them of the non-conformance.

Groundwater Receptors

During the RI conducted by the USEPA, active private wells were identified downgradient from the Kraus and Henfield Parcels (CH2M HILL, 1984). Sampling of those wells at the time indicated that they were not impacted by the Old Mill Site. However, at the recommendation of the USEPA, public water was made available to those well owners. In February 2003, BC contacted the Village of Rock Creek Water Department and verified that there were no private potable wells in use in the vicinity of the Site, except for one up/side-gradient address (3215 Railroad Street). That one property owner elected not to convert to public water. However, data collected and evaluated to date indicate that residence is not impacted by Site conditions. For example, the two wells between (i.e., cross-gradient of) this residence and the Kraus Parcel plume that are considered to be the best indicators of what could potentially migrate toward the residence are shallow wells RWSK-2 and RWSK-13. None of the contaminants of concern have been detected in RWSK-13 during any annual sampling event since it was installed and first sampled in 2002. Only TCE has been detected in RWSK-2 since it has been sampled annually beginning in 2002. The lone detection of TCE occurred during the 2002 sampling event when it was detected at a concentration of 1.55 ug/L, compared to the action level of 5 ug/L. TCE has not been detected in this well in any subsequent annual sampling events. These data, combined with the knowledge that the residence well is located several hundred feet cross-gradient from the Site, support the lack of impact to the residence well from the Site.

The Village of Rock Creek obtains its water supply from a surface water intake from the Grand River. The intake is located approximately 1.5 miles from the Old Mill Site and is upstream from the river's confluence with Rock Creek. The Village of Roaming Shores obtains its water supply from a surface water intake from Lake Roaming Rock, a lake formed by the damming of Rock Creek. This intake is located approximately ½-mile southeast from the Old Mill Site, which is both upgradient and upstream from the Site.

Shallow groundwater from the Site flows generally westward and likely discharges into the Grand River or its eastern tributaries (including Rock Creek). Groundwater ultimately discharges into the Grand River downstream from the Village of Rock Creek's public water intake.

In summary, there is not a readily apparent completed pathway for exposure to groundwater emanating from the Old Mill Site, either in the form of groundwater users or surface water receptors.

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1.2 Background and History

Both parcels (Kraus and Henfield) were used in the past to store drums of waste, including solvents, oils, resins, and PCBs. USEPA response activity at the Site began in 1979 and some removal activities were performed during the period November 1981 to November 1982. The Site was proposed for inclusion on the National Priorities List (NPL) in December 1982 and was included on the NPL in September 1983. CH2M Hill, under contract to USEPA, conducted a Remedial Investigation (RI) at the Site from August 1983 to December 1984 (CH2M Hill, 1984, 1985). The RI indicated the soils were contaminated with trichloroethene (TCE), dichloroethene (DCE), 1,1-DCE, vinyl chloride, 1,1,1-trichloroethane, ethylbenzene, and xylene. TCE was the principal contaminant of concern, measured most consistently at the higher concentrations. In the 1985 Record of Decision (ROD), the USEPA selected a final Site remedy that included removal and off-site disposal of impacted soil, collection and on-site treatment of impacted groundwater, implementation of aquifer use restrictions, and provision of an alternative water supply for one local residence. Approximately 1,200 drums of waste and 6,500 cubic yards of soil were removed from the Site for off-site disposal in the 1980's. The ROD requires collection and treatment of impacted groundwater until 10^{-5} risk levels are attained. Allowable residual contaminant (ARC) criteria for groundwater were established in the ROD. The USEPA indicated in its Five-Year Review (USEPA, January 17, 1996) of this Site that constituents for which Maximum Contaminant Levels (MCLs) are available shall supercede the ARCs set in the ROD as objectives for Site remediation. The list of constituents of concern, as presented in the Five-Year Review, is presented in Table 1 along with the associated current MCLs. Construction of this remedy, as originally conceived, was completed in August 1989

and operation of the groundwater collection and treatment system was implemented thereafter. Additional groundwater collection trenches and extraction wells were installed at various times during 1992 to 1994 to augment the system.

Roy F. Weston, Inc., as a USEPA contractor, performed O&M at the Site from August 1989 until September 2000. Per an agreement with the USEPA, the State of Ohio assumed O&M responsibilities for the Site in January 2001, and operated the Site until April 29, 2002. IT Corporation, as a contractor to Ohio EPA, performed O&M activities during that period. The PRP Group assumed the O&M responsibilities on April 29, 2002. The PRP Group retained BC as the Supervising Contractor for the O&M activities at the Site.

An O&M Work Plan was prepared by BC in accordance with the SOW developed for this Site and was subsequently approved by the USEPA and Ohio EPA. The Work Plan provided a description of the activities required to operate and maintain the groundwater extraction and treatment system at the Site to ensure its effectiveness at containing and remediating affected groundwater. The Work Plan was approved by the Agencies and the Old Mill PRP Defense Group assumed formal responsibility for O&M of the Site on April 29, 2002. In June 2002, BC provided oversight of the installation of five additional monitoring wells and the continuation of O&M, and performed the required compliance monitoring (i.e., collection and analysis of groundwater samples and treatment facility influent and effluent samples, and collection of groundwater elevation data). Two of the new wells (RWSH-5 and RWDH-5) were installed on the Henfield Parcel to supplement monitoring of the shallow and deeper water-bearing zones, respectively, in the area south of the groundwater collection trench associated with the Martin Sump. Two other new wells (RWSK-11 and RWSK-12) were installed on the Kraus Parcel to supplement monitoring of the shallow water-bearing zone downgradient and sidegradient to the groundwater collection trench associated with the Kraus Additional Sump. The fifth new well (RWSK-13) was installed on the Kraus Parcel north-northeast of the Kraus Sump to provide a non-detect boundary for this area of the Site. Also in June 2002, as part of site improvement, BC provided oversight of the abandonment of seven unused monitoring wells.

In addition to initiating the required compliance monitoring in 2002, BC also began the evaluation for MNA at the Site at that time, culminating in the issuance of the MNA Technical Memorandum on October 31, 2003. The MNA evaluation was performed in accordance with the Agency-approved scope of work described in Appendix C of the Work Plan for Long-Term Operation and Maintenance (Brown and Caldwell, 2001). The scope of work was consistent with USEPA's guidance contained in their document titled "Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater" (USEPA, 1998). The purpose of the evaluation was to assess the hydrogeological and hydrogeochemical conditions at the Site to determine if existing conditions are favorable for biodegradation, an important component of natural attenuation. The MNA evaluation consisted of several components, including review of Site geology/hydrogeology, review of groundwater chemistry, and determination/evaluation of potential groundwater receptors. Selected monitoring wells at the Site were sampled by low-flow sampling methodology. The MNA sampling occurred concurrently with the baseline groundwater sampling event during July/August, 2002. The analytical parameters included VOCs, inorganic/metals, and bioparameters, which are often used to assess the potential for biodegradation to be occurring within an aquifer. In addition, data from the first annual groundwater sampling event (May 2003) were also reviewed.

The findings of the MNA evaluation indicated that the shallow groundwater plume(s) at the Site are essentially in steady state. Reductive dechlorination, as well as chemical degradation, of groundwater constituents has occurred at the Site, and geochemical conditions are favorable for the continuation of reductive dechlorination through biodegradation. Finally, there is a general lack of downgradient groundwater receptors from the Site. These findings indicate that the Old Mill Site is a legitimate candidate for MNA and support pilot testing MNA and/or enhanced MNA at the Site.

In November 2004, subsequent to completing the initial MNA evaluation, and in preparation for the MNA Pilot Test, BC provided oversight of the installation of two additional shallow monitoring wells on the Henfield Parcel, RWSH-6 and RWSH-7, to assist in the continued evaluation of the applicability of monitored natural attenuation (MNA) at the site. Following development, the wells were sampled in January 2005 and analyzed for

the same VOCs, inorganic/metals, and bioparameters as used in the initial MNA evaluation. The analytical data and well logs for these two wells are presented in Appendix A.

2.0 TECHNICAL APPROACH

This section describes the methods and procedures to be used in setting up and conducting the MNA Pilot Test, including the temporary decommissioning, or "mothballing", of the groundwater extraction/treatment system, and application of biodegradation additives to the shallow water-bearing zone. The groundwater extraction/treatment system will be temporarily decommissioned so that it may be re-started in the event that it is required as part of a contingency measure. Evaluation of data collected during the MNA Pilot Test will determine whether justification exists for the treatment plant to be permanently decommissioned.

The benefits of applying biodegradation additives to soil and groundwater systems as a mechanism to promote and accelerate dechlorination has been recognized by USEPA for over a decade. In research conducted at the Robert S. Kerr Environmental Research Laboratory in Ada, Oklahoma, USEPA acknowledges that the addition of electron donor/acceptor combinations to media contaminated with chlorinated solvents can significantly improve dechlorination rates. Successful pilot and field studies conducted by individual members of the Old Mill Settling Defendants at other sites with similar contaminants further support the use of biodegradation additives.

Although Brown and Caldwell is confident that groundwater constituent concentrations will naturally attenuate to below the respective MCLs within a reasonable downgradient distance on the Kraus Parcel, biodegradation additives will be applied to the shallow water-bearing zone through the appropriate existing groundwater interceptor trenches and wells to accelerate the degradation processes. Because there is less buffer between the plume and downgradient property boundary on the Henfield Parcel, the pilot program on the Henfield Parcel may be more reliant on the addition of biodegradation additives to the shallow plume through the existing groundwater interceptor trenches and wells. The application of these biodegradation additives, combined with monitoring, will provide important data for evaluating the long-term effectiveness of MNA/enhanced MNA at the Site, as well as serve to reduce the source concentration and ultimate "cleanup" time. As the Pilot Study

progresses, the appropriateness of the selected additive injection points will be re-evaluated. Proposed changes will be proposed to OEPA for review and discussion.

2.1 Temporary Decommissioning of the Groundwater Extraction System

Each of the eight extraction wells and sumps on the Henfield and Kraus Parcels are housed within concrete vaults measuring approximately eight feet square and covered by a lockable aluminum lid, which can be completely removed. The bottoms of the vaults are open to the underlying ground surface covered with gravel. Electrical conduit and piping enters and exits the vaults through the open bottom and is totally underground between the vaults and the treatment building.

Electricity to the pumps will be turned off at the main panel and the electrical disconnect and controls located in the vault will be removed. The riser piping for the pump will be disconnected from the piping within the vault, and the pump and riser piping will then be pulled from the well or sump. The flow totalizer meter will be disconnected from the piping within the vault as well. The pump, riser piping, flow totalizer meter and electrical disconnect and controls will be labeled to designate which vault they were removed from and taken to the treatment plant for storage. Care will be taken to capture and containerize any dripping from the pumps, piping, and meters as they are removed. The containerized drippings will be transferred to the treatment building interior sump for treatment through the on-site treatment facility prior to de-activation of the treatment system. Prior to storing, the pumps, riser piping and flow totalizer meters will be triple rinsed in the treatment building with potable water and all but the pumps will be allowed to air dry, and then stored in a secure location within the treatment building. Following rinsing, the pumps will be placed into a drum and potable water will be added to the drum until all of the pumps are submerged. The pumps will be stored in the drum within the treatment building in this manner to keep the pump seals moist, water will be added to the drum as necessary over time. The rinse water will be transferred to the interior sump for treatment through the on-site treatment system prior to its de-activation. Following removal of these items from the vault, any remaining piping (i.e., the buried pipe leading to the common underground

manifold) and electrical connections/conduit will be secured with waterproof caps or connections as appropriate. Finally, the vault lids will be placed back onto the vaults and locked in place.

2.2 Temporary Decommissioning of the Treatment System

The de-activation of the treatment system will begin following de-activation of the extraction system. The de-activation process will involve flushing the system with potable water sequentially in order to purge the system of any remaining influent groundwater. Following flushing, the feed tank, air stripping tower, and carbon vessel will be drained and all the valves left open. The motors and pumps will be left in place and the power to the treatment system will be turned off. However, the power to the system will be turned on and the motors and pumps will be "bumped" on a monthly basis in order to keep the seals lubricated. The temperature in the treatment building will be maintained at approximately 45°F, or higher, in order to avoid exposing the electronic circuits and boards to potentially damaging subfreezing temperatures.

2.3 Application of Biodegradation Additives

In order to promote and accelerate dechlorination within the shallow water-bearing zone, following the temporary de-activation of the groundwater collection and treatment systems, biodegradation additives (i.e., electron donors) will be applied to the shallow water-bearing zone by injection into the appropriate existing groundwater interceptor trenches and wells. On the Henfield Parcel, additives will be applied to the Martin Trench/Sump and to monitoring well RWSH-6. On the Kraus Parcel, additives will be applied to the Kraus Trench/Sump, the Modified Kraus Trench/Sump, the Krause Additional Trench/Sump, and monitoring well RWSK-5. The purpose of adding the additives to the trenches is to distribute the electron donor material to a broad cross section of the plume in order to promote degradation, and also to safeguard against contaminant breakthrough. The two monitoring wells selected to receive additives are each near the perceived "core" of the two respective plumes and therefore provide direct access to what is considered to be the source

areas of the plume. The trenches/wells scheduled for biodegradation additives are shown on Figure 2, along with a typical plume delineation for the Site.

The biodegradation additive will consist of hydrogen release compound (HRC) manufactured by Regenesis, Inc. HRC contains lactic acid and the hydrogen released during the breakdown of the lactic acid promotes reductive dechlorination in the saturated zone. Two types of HRC will be employed during the MNA Pilot Study. Traditional HRC will be applied to the trenches, whereas extended release HRC, or HRC-X, will be applied to the two monitoring wells. Applications will be made on a quarterly basis unless data collected during the pilot study indicates a greater or lesser frequency is appropriate. However, the frequency of applications will not be changed without Ohio EPA's approval.

Application of the HRC-X into the two monitoring wells will consist of manually pouring 10 gallons of HRC directly into each of the shallow wells. Prior to pouring, each bucket of HRC will be heated to approximately 90˚F within a hot water bath to lower its viscosity and facilitate pouring. Application of the HRC into the trenches will be accomplished through the sump and cleanouts. The volume of substance added to each trench will be adequate to achieve an initial HRC concentration in the trench and immediate vicinity of at least 500 ppm, as recommended by Regenesis, Inc. Based on an average trench thickness of 3 feet, a saturated thickness of 2 feet, and porosity of 35%, the volume of HRC needed per application event for each of the trenches would be as follows:

Kraus Trench/Sump	25 gallons HRC
Kraus Modified Trench/Sump	25 gallons HRC
Kraus Additional Trench/Sump	100 gallons HRC
Martin Trench/Sump	100 gallons HRC

Similar to application of the substance to the monitoring wells, the application of the HRC to the trenches will begin by pre-heating the additive in a hot water bath to approximately

90˚F. The HRC will then be applied to the trench via tremie method into the sump and cleanouts. A hose may be inserted into the trench lateral perforated pipe, and the heated HRC pumped through the hose into the lateral while slowly pulling the hose back through the trench. The most appropriate method of effectively distributing the HRC throughout the trenches will be field-determined, but will likely consist of a trailer-mounted system that includes a heated mixing tank, pump, tremie pipe and a spool of rubber hose.

Under Ohio Administrative Code (OAC), Chapter 3745-34, injection of the biodegradation additive into the sumps and covered trenches within the shallow groundwater zone constitutes a Class V injection well. However, since the remediation wells are needed as part of the clean up effort approved by USEPA and Ohio EPA under CERCLA, the wells are approved by rule as long as inventory information is submitted, and exempted from formal permitting requirements (OAC 3745-34-08(C)). A copy of this work plan will be submitted to Underground Injection Control unit under the Division of Drinking and Ground Waters in the Central Office of Ohio EPA to satisfy the requirements of inventory information.

3.0 GROUNDWATER MONITORING PROGRAM

This section serves as an addendum to the existing Field Sampling and Analysis Plan (FSAP), a component of the LTMP Work Plan, and addresses tasks related to the collection of field data and samples at the Site during the MNA Pilot Study. In particular, this section addresses the monitoring locations, frequency, and field and laboratory analytical parameters to be used during the MNA Pilot Study. Sampling and analytical procedures will be in accordance with the approved FSAP and Quality Assurance Project Plan (QAPP) developed for the Site and used during the routine O&M sampling events. The contaminants of concern (COCs) during the Pilot Study will be consistent with those historical COCs at the Site, and will include tetrachloroethene, trichloroethene, 1,1,1-trichloroethane, cis-1,2-dichloroethene, trans-1,2-dichloroethene, and vinyl chloride.

3.1 Initial Sampling Event

To ensure there is not a "quick" breakthrough of impacted groundwater beyond the collection trenches and/or property boundary, six shallow monitoring wells will be sampled approximately three months following system shutdown. The six monitoring wells will include two downgradient monitoring wells on the Henfield Parcel (RWSH-3 and RWSH-4), and four monitoring wells on the Kraus Parcel (RWSK-2, RWSK-9, RWSK-10, and RWSK-12). The latter three wells are downgradient wells. RWSK-2 is an up/side-gradient well, but is the closest well to the only potable water well in the vicinity of the Site still in use, which is located at 3215 Railroad Street, and is being sampled to ensure that the plume does not migrate in that direction. These samples will be analyzed for VOCs.

3.2 Semi-Annual Sampling Events

Twelve shallow monitoring wells will be sampled semi-annually for the four-year MNA Pilot Study. On the Henfield Parcel, downgradient monitoring wells RWSH-3 and RWSH-4, cross-gradient monitoring wells RWSH-2 and RWSH-5, and newly installed plume monitoring well RWSH-6 will be sampled. On the Kraus Parcel, downgradient monitoring

wells RWSK-9, RWSK-10, and RWSK-12; cross/upgradient monitoring wells RWSK-2, RWSK-6, and RWSK-11; and plume monitoring well RWSK-5 will be sampled.

Wells will be purged and sampled via the micro-purge (i.e. low flow) sampling method. Samples will be analyzed for VOCs and representative bioparameters. The bioparameters will be measured in the field via field test kits and instruments. The bioparameters will include dissolved oxygen (DO), manganese (II), iron (II), sulfide, sulfate, nitrates, chloride, carbon dioxide, pH, oxidation-reduction potential (ORP), temperature, conductivity, and turbidity. The sampling seasons will be alternated each year, so that each of the four seasons is sampled twice during the four-year pilot study.

Because plume monitoring wells RWSK-5 and RWSH-6 will be used as injection points for biodegradation additives, the appropriateness to sample these wells during each proposed event will be evaluated and discussed with Ohio EPA prior to that sampling event.

3.3 Annual Sampling Events

Nineteen additional monitoring wells will be sampled on an annual basis during the four-year MNA Pilot Study, consistent with the current LTMP scope. To ensure that bedrock groundwater is adequately evaluated during the Pilot Study, thirteen of the additional monitoring wells will be the deeper monitoring wells. On the Henfield Parcel, the deep monitoring wells to be sampled are upgradient monitoring well RWDH-1, cross-gradient monitoring wells RWDH-2 and RWDH-5, and downgradient monitoring wells RWDH-3 and RWDH-4. In addition, shallow upgradient monitoring well RWSH-1 will be sampled. On the Kraus Parcel, the deep monitoring wells to be sampled are upgradient monitoring well RWDK-1; cross/upgradient monitoring wells RWDK-2, RWDK-3 and RWDK-4; cross gradient monitoring well RWDK-6; and plume monitoring wells RWDK-5, RWDK-7 and RWDK-8. The shallow monitoring wells to be sampled are upgradient monitoring well RWSK-1; cross/upgradient monitoring wells RWSK-3 and RWSK-4; and plume monitoring wells RWSK-7 and RWSK-8. These samples will be analyzed for VOCs.

Because plume monitoring wells RWSK-5 and RWSH-6 will be used as injection points for biodegradation additives, the appropriateness to sample these wells during each proposed event will be evaluated and discussed with Ohio EPA prior to that sampling event.

3.4 Water Level Measurements

Groundwater elevation data will be collected from all monitoring wells and piezometers on a quarterly basis, consistent with the ongoing LTMP.

4.0 DATA MANAGEMENT PLAN

The Data Management Plan, a component of the Work Plan for the MNA Pilot Study at the Site, addresses data compilation, tabulation, evaluation, and reporting and communication. Data management is critical to monitoring the progress of the MNA Pilot Study and is discussed in further detail below.

4.1 Compilation and Maintenance of Data

The O&M Contractor shall reduce analytical data and water level data to tabular formats and maintain these data in an electronic database. Water quality and water level data collected from the performance of MNA Pilot Study tasks at the Site shall be maintained by the PRPs in a useable format that shall allow evaluation of the data by the PRPs, O&M Contractor, and regulatory agencies. Appropriate files shall be maintained on site, while copies of all files shall be maintained by the O&M Contractor in its project files.

4.2 Data Evaluation

The data will be evaluated for usefulness and for validation of the effectiveness of the MNA Pilot Study in accordance with the methods described below.

4.2.1 Data Usability and Field QA/QC

In accordance with the FSAP and the QAPP, field quality assurance/quality control (QA/QC) samples will be collected during each sampling event. Field QA/QC samples will include trip blanks, equipment blanks, and field duplicates as appropriate. These data shall be evaluated with respect to criteria set forth in the QAPP for acceptability of the associated data. Field QA/QC samples shall be collected in an aggregate amount equal to at least 5 to 10 percent of monitoring samples.

4.2.2 Groundwater Data Evaluation

The primary objective of the data evaluation will be assess contaminant degradation at the Site during the pilot study, both in terms of the amount occurring and whether conditions are favorable for continued degradation to occur over time. The groundwater analytical data will also be reviewed for indications that impacted groundwater migrating into areas of previously unaffected groundwater, and specifically beyond the hydraulic influence of the groundwater extraction network. Water level data shall be reviewed for indications of variance in groundwater flow patterns that could affect plume migration.

4.3 Reporting

Status reports of the MNA Pilot Study will be transmitted to the agencies in accordance with the monthly progress reporting requirement of the SOW and the reporting described in this Work Plan. In addition, if necessary, the agencies shall be notified as soon as practicable if evaluations of Site data indicate significant deviations from expected behavior at the Site (see Section 6.0, Contingency Plan). Specific reporting tasks are discussed below.

Semi-Annual and Annual Performance Reports

Semi-Annual status reports and Annual Performance Reports shall be prepared and submitted to the Agencies that summarizes progress of the MNA Pilot Study. Semi-annual reports will include the results of semi-annual groundwater sampling and analysis from the subset of wells designated for semi-annual sampling. Annual Performance Reports will include the results of the all groundwater sampling and analysis that occurred during that year, in addition to a discussion of the status of the MNA Pilot Study and recommendations for pilot study enhancements, if any. The format of the Annual Performance Reports will be similar to those that are presently being prepared in accordance with the LTMP.

Meetings and Other Communication

As necessary, meetings shall be held during the course of the MNA Pilot Study. The Agencies shall be kept apprised of the status of the Pilot Study via the various reporting

requirements. Also, Ohio EPA shall be notified as soon as practicable of deviations or excursions from normal operating conditions at the Site (see Section 6.0).

MNA Pilot Test Summary Report

Following completion of the MNA Pilot Study, a summary report will be prepared that presents and discusses the finding of the study. The report will include recommendations with respect to the long-term applicability of MNA to the site, as well as the associated performance criteria, monitoring program, fate of the groundwater extraction/treatment system, and contingencies. The summary report will be transmitted to the regulatory agencies within 90 days following receipt of the analytical data from the final annual sampling event. Full-scale implementation of MNA/enhanced MNA will not occur without prior approval from Ohio EPA. During the report preparation, submittal, and OEPA review period, annual sampling at the Site will continue in accordance with the approved LTMP O&M Work Plan.

Components of the MNA Pilot Test Summary Report are anticipated to include, but necessarily be limited to the following:

- Executive Summary
- Introduction and Background
- Scope of Work
    - Mothballing Existing Groundwater Collection/Treatment System
    - Groundwater Monitoring
    - Injection of Biodegradation Additives
    - Data Evaluation
- Results
- Conclusions
    - Long-term Applicability of MNA at the Site.
    - COC Plume Cleanup Time Estimates
- Recommendations
- References

- Tables
    - Wells Sampled
    - Paramater List
    - Summary of Groundwater Quality Data
    - Summary of Biodegradation Additives Injected per Location

- Figures
    - Recent Shallow Groundwater Potentiometric Surface Maps
    - COC Plume Maps
    - Trend Analyses Plots for COCs
    - Hydrostratigraphic Cross-Sections
- Appendices
    - Laboratory Analytical Reports
    - Water Level Measurement Raw Data

5.0 CONTINGENCY PLAN

This Contingency Plan identifies the steps to be taken during the MNA Pilot Study to address excursions that could occur during the study. Examples of such excursions that would trigger implementation of the Contingency Plan include, but are not limited to, the following:

- Evidence of breakthrough or other bypass of impacted groundwater beyond the influence of the collection trenches/wells and towards areas of uncontaminated groundwater and/or property boundary.

- Irregular water level measurements in the groundwater monitoring wells (i.e., if water levels suggest a significant deviation in flow direction from historical data).

- A significant increase in constituent concentration at a specific monitoring location.

It is in the interest of all stakeholders to act quickly to respond to excursions that may occur during the MNA Pilot Study. Therefore, steps have been set up in this Contingency Plan to be implemented that will allow appropriate actions to occur in a timely manner. In the event of an excursion, Ohio EPA will be notified immediately following verification of the data. Initial notification will be made by telephone. Subsequent to the initial notification, one of two courses of action will be implemented. The first course of action will apply if an excursion is observed in a monitoring well downgradient of the capture zone of the existing groundwater collection system, and would consist of an immediate resampling of the well to confirm the initial exceedance. Following receipt of the resampling event data, OEPA will be notified again to discuss the appropriate action, which would include.

The second course of action will apply for all other excursions and includes preparation of a specific written plan of action to address the excursion. This written plan shall be submitted to the USEPA and Ohio EPA for review and approval no later than 30 days following the

date of the event. At a minimum, the written plan of action will include the following information:

- A description of the excursion/situation.
- Actions to be taken by the O&M Contractor.
- A schedule for implementation of the specific tasks.
- The responsibilities of the various parties, including any subcontractors.
- A list of people that have been notified.

The written plan of action might include one of the following action items:

- Continued monitoring,
- Increased monitoring,
- Re-activation of all or part of the groundwater collection/treatment system.

Contact information for various responsible parties is presented below:

Contact Name	**Affiliation**	**Contact Number**
Michael Watkins	Brown and Caldwell	440-863-2173
Dennis Brock	Brown and Caldwell	440-863-2164
Andrew Kocher	Ohio EPA	330-963-1249
Michael Eberle	Ohio EPA	330-963-1126
Rod Beals	Ohio EPA	330-963-1218
Linda Kern	US EPA	312-886-7341
Scott Mullin	Regenisis	630-753-0836
Rock Creek Fire Department	Rock Creek Fire Department	911 or 440-563-3000
Memorial Hospital of Geneva	Memorial Hospital of Geneva	440-466-1141
Poison Control Center	Poison Control Center	911 or 440-231-4455
Ohio EPA Spill Hotline	Ohio EPA Spill Hotline	800-282-9378
Ashtabula County Sheriff	Ashtabula County Sheriff	911 or 440-576-0055

6.0 HEALTH AND SAFETY PLAN

The existing Health and Safety Plan (HASP) for the LTMP will be used during the MNA Pilot Study. Because the proposed HRC products are "food grade", special safety considerations when handling these substances will not be required. However, the manufacturer recommends that vinyl or rubber gloves and protective eyeware be worn when handling HRC, and that an eye wash station be nearby. The material safety data sheets (MSDS) for these substances are included in Appendix B.

7.0 SCHEDULE

A preliminary schedule for the MNA Pilot Study is included as Figure 3. The schedule will be initiated upon approval of this Work Plan by OEPA, and weather permitting for the first application of the biodegradation additives.

8.0 REFERENCES

Brown and Caldwell, 2001. Work Plan for Long-Term Operation and Maintenance at the Old Mill Superfund Site, June 2001.

Brown and Caldwell, 2006. Technical Memorandum, Montiored Natural Attenuation (MNA) Evaulation, February 9, 2006.

CH2M HILL, 1984. Remedial Investigation Report, December 3, 1984.

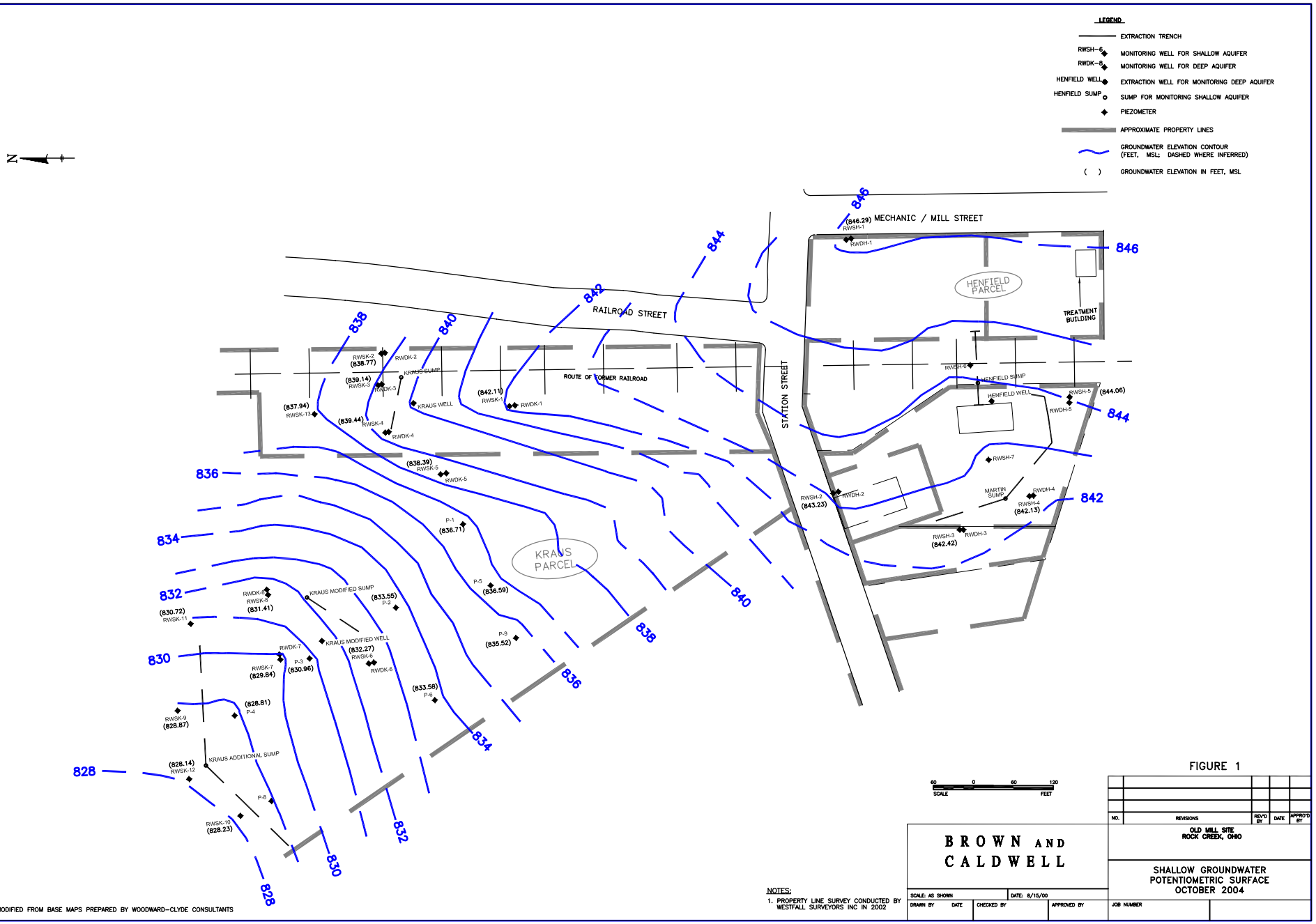
CH2M HILL, 1985. Addendum to Remedial Investigation Report, May 31, 1985.

TABLE 1

CONSTITUENTS OF CONCERN AND CLEANUP GOALS

Parameter	Cleanup Goal (MCL)	Method Detection Limit (MDL)	Method Reporting Limit
1,1,1-Trichloroethane	200	0.13	1.0
cis-1,2-Dichloroethene	70	0.1	1.0
Tetrachloroethene	5	0.15	1.0
trans-1,2-Dichloroethene	100	0.1	1.0
Trichloroethene	5	0.18	1.0
Vinyl chloride	2	0.16	1.0
bis(2-ethylhexyl)phthalate	6	0.31	1.0

* All values are in ug/L - ppb.


LEGEND
EXTRACTION TRENCH
RWSH-6 MONITORING WELL FOR SHALLOW AQUIFER
RWDK-8 MONITORING WELL FOR DEEP AQUIFER
HENFIELD WELL EXTRACTION WELL FOR MONITORING DEEP AQUIFER
HENFIELD SUMP SUMP FOR MONITORING SHALLOW AQUIFER
PIEZOMETER
APPROXIMATE PROPERTY LINES
GROUNDWATER ELEVATION CONTOUR (FEET, MSL; DASHED WHERE INFERRED)
( ) GROUNDWATER ELEVATION IN FEET, MSL
N
MECHANIC / MILL STREET
RAILROAD STREET
STATION STREET
ROUTE OF FORMER RAILROAD
HENFIELD PARCEL
KRAUS PARCEL
TREATMENT BUILDING
KRAUS WELL
KRAUS SUMP
KRAUS MODIFIED SUMP
KRAUS MODIFIED WELL
KRAUS ADDITIONAL SUMP
HENFIELD SUMP
HENFIELD WELL
MARTIN SUMP
(846.29) RWSH-1
RWDH-1
RWSK-2 (838.77)
RWDK-2
(839.14) RWSK-3
RWDK-3
(837.94) RWSK-13
(839.44) RWSK-4
RWDK-4
(842.11) RWSK-1
RWDK-1
(838.39) RWSK-5
RWDK-5
RWSH-8
RWSH-5 (844.06)
RWDH-5
RWSH-7
RWSH-2 (843.23)
RWDH-2
RWSH-4 (842.13)
RWDH-4
RWSH-3 (842.42)
RWDH-3
P-1 (836.71)
P-5 (836.59)
P-9 (835.52)
P-2 (833.55)
P-6 (833.58)
P-3 (830.96)
P-4 (828.81)
P-8
RWDK-8
RWSK-8 (831.41)
RWSK-11 (830.72)
RWDK-7
RWSK-7 (829.84)
RWSK-6 (832.27)
RWDK-6
RWSK-9 (828.87)
RWSK-12 (828.14)
RWSK-10 (828.23)
846
844
842
840
838
836
834
832
830
828
60 0 60 120
SCALE FEET
FIGURE 1
NO. REVISIONS REV'D BY DATE APPR'D BY
OLD MILL SITE
ROCK CREEK, OHIO
BROWN AND CALDWELL
SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE OCTOBER 2004
SCALE: AS SHOWN
DATE: 8/15/00
DRAWN BY DATE
CHECKED BY
APPROVED BY
JOB NUMBER
NOTES:
1. PROPERTY LINE SURVEY CONDUCTED BY WESTFALL SURVEYORS INC IN 2002
SOURCE: MODIFIED FROM BASE MAPS PREPARED BY WOODWARD-CLYDE CONSULTANTS
DRAWING NO. 18172-018 (CLEVE) DATE: 8/15/00 PLOT SCALE 1=60

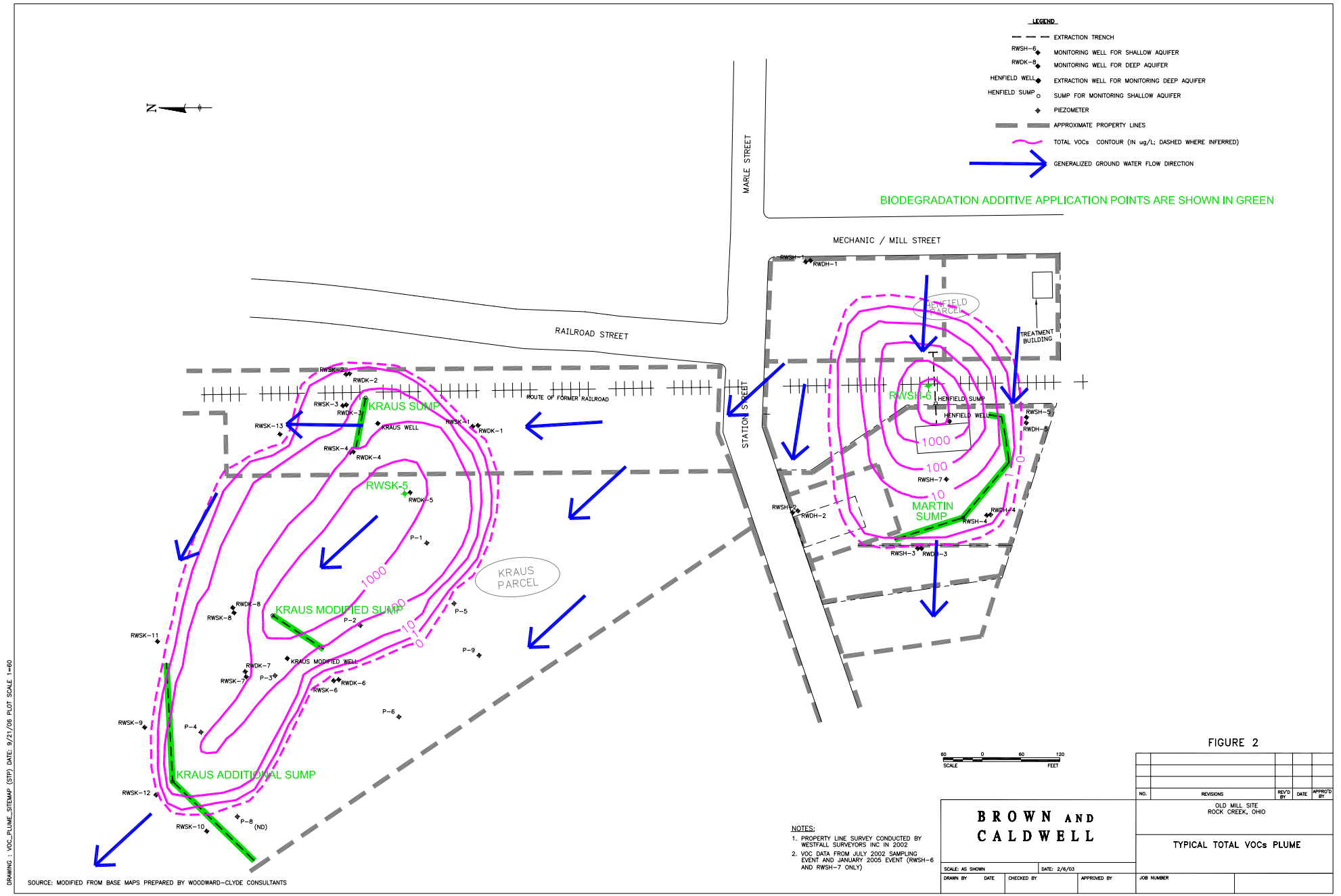


FIGURE 2

NOTES:
1. PROPERTY LINE SURVEY CONDUCTED BY WESTFALL SURVEYORS INC IN 2002
2. VOC DATA FROM JULY 2002 SAMPLING EVENT AND JANUARY 2005 EVENT (RWSH-6 AND RWSH-7 ONLY)

SOURCE: MODIFIED FROM BASE MAPS PREPARED BY WOODWARD-CLYDE CONSULTANTS

DRAWING : VOC_PLUME_SITEMAP (STP) DATE: 9/21/06 PLOT SCALE 1=60

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

BROWN AND CALDWELL

OLD MILL SITE
ROCK CREEK, OHIO

TYPICAL TOTAL VOCs PLUME

SCALE: AS SHOWN	DATE: 2/6/03		
DRAWN BY DATE	CHECKED BY	APPROVED BY	JOB NUMBER

FIGURE 3

PRELIMINARY SCHEDULE

OLD MILL MNA PILOT STUDY

Task			Year 1												Year 2												Year 3												Year 4												Year 5							
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8
OEPA Approval of MNA Pilot Study Work Plan	*																																																								
Treatment System Temporary Decommissioning			■																																																					
Electron Donor (HRC) Application			■			■			■			■			■			■			■			■			■			■			■			■			■			■			■			■			■			■			
Quarterly Sampling Event						■																																																		
Semi-Annual Sampling Event									■						■									■						■																												
Annual Sampling Event			■												■												■												■												■						
Quarterly Water Levels			■			■			■			■			■			■			■			■			■			■			■			■			■			■			■			■			■			■			■
Preparation of Annual Performance Report					■	■											■	■											■	■											■	■											■	■				
Preparation of MNA Pilot Study Summary Report																																																					■	■	■				

APPENDIX A

ANALYTICAL DATA AND WELL LOGS
FOR MONITORING WELLS RWSH-6 AND RWSH-7

APPENDIX B

MSDSs FOR HRC AND HRC-X

Hydrogen Release Compound (HRC®)
MATERIAL SAFETY DATA SHEET (MSDS)

Last Revised: **February 10, 2004**

Section 1 - Material Identification

Supplier:

REGENESIS
1011 Calle Sombra
San Clemente, CA 92673
Phone: **949.366.8000**
Fax: **949.366.8090**
E-mail: **info@regenesis.com**

Chemical Name:	**Propanoic acid, 2-[2-[2-(2-hydroxy-1-oxopropoxy)-1-oxopropoxy]-1-oxopropoxy]-1,2,3-propanetriyl ester**
Chemical Family:	**Organic Chemical**
Trade Name:	**Hydrogen Release Compound® (HRC®)** **Glycerol tripolylactate and Glycerol**
Product Use:	**Used to remediate contaminated soil and groundwater (environmental applications)**

Section 2 – Chemical Identification

CAS#	Chemical
201167-72-8	**Glycerol Tripolylactate**
56-81-5	**Glycerol**
50-21-5	**Lactic Acid**

Section 3 - Physical Data

Melting Point:	**Not Available (NA)**
Boiling Point:	**Not Determined (ND)**
Flash Point:	**ND**
Density:	**1.3 g/cc**

Section 3 – Physical Data (cont)

Solubility:	**Acetone and DMSO**
Appearance:	**Viscous amber gel/liquid**
Odor:	**Not detectable**
Vapor Pressure:	**None**

Section 4 - Fire and Explosion Hazard Data

Extinguishing Media: **Carbon Dioxide, Dry Chemical Powder or Appropriate Foam.**

Water may be used to keep exposed containers cool.

For large quantities involved in a fire, one should wear full protective clothing and a NIOSH approved self contained breathing apparatus with full face piece operated in the pressure demand or positive pressure mode as for a situation where lack of oxygen and excess heat are present.

Section 5 - Toxicological Information

Acute Effects: **May be harmful by inhalation, ingestion, or skin absorption. May cause irritation. To the best of our knowledge, the chemical, physical, and toxicological properties of the glycerol tripolylactate have not been investigated. Listed below are the toxicological information for glycerol and lactic acid.**

RTECS#: **MA8050000**
Glycerol

Irritation data:

SKN-RBT 500 MG/24H MLD	**BIOFX* 9-4/1970**
85JCAE-,207,1986	**85JCAE-,207,1986**
EYE-RBT 126 MG MLD	**85JCAE -,656,86**
EYE-RBT 500 MG/24H MLD	**AJOPAA 29,1363,46**
SKN-RBT 5MG/24H SEV	
EYE-RBT 750 UG SEV	

Section 5 – Toxicological Information (cont)

Toxicity data:	**ORL-MUS LD50:4090 MG/KG**	**NIIRDN 6,215,1982**
	FRZKAP (6),56,1977	**FEPRA7 4,142,1945**
	SCU-RBT LD50:100 MG/KG	**RCOCB8 56,125,1987**
	ORL-RAT LD50:12600 MG/KG	**ARZNAD 26,1581,1976**
	IHL-	**ARZNAD 26,1579,1978**
	RATLC50:>570MG/M3/1HBIO	**NIIRDN 6,215,1982**
	FX*9-4/1970 IPR-RAT LD50:	**JAPMA8 39,583,1950**
	4420 MG/KG	**DMDJAP 31,276,1959**
	IVN-RAT LD50: 5566 MG/KG	**BIOFX* 9-4/1970**
	IPR-MUS LD50: 8700 MG/KG	**NIIRDN 6,215,1982**
	SCU-MUS LD50: 91 MG/KG	**FMCHA2-,C252,91**
	IVN-MUS LD50: 4250 MG/KG	**FMCHA2-,C252,91**
	ORL-RBT LD50: 27 GM/KG	**FAONAU 40,144,67**
	SKN-RBT LD50:>10GM/KG	**JIHTAB 23,259,41**
	IVN-RBT LD50: 53 GM/KG	**FMCHA2-,C252,91**
	ORL-GPG LD50: 7750 MG/KG	**JIHTAB 23,259,1941**
	ORL-RAT LD50:3543 MG/KG	
	SKN-RBT LD50:>2 GM/KG	
	ORL-MUS LD50: 4875 MG/KG	
	ORL-GPG LD50: 1810 MG/KG	
	ORL-QAL LD50: >2250 MG/KG	
Target Organ data:	**Behavioral (headache), gastrointestinal (nausea or vomiting), Paternal effects (spermatogenesis, testes, epididymis, sperm duct), effects of fertility (male fertility index, post-implantation mortality).**	
RTECS#:	**OD2800000** **Lactic acid**	

Only selected registry of toxic effects of chemical substances (RTECS) data is presented here. See actual entry in RTECS for complete information on lactic acid and glycerol.

Section 6 - Health Hazard Data

Handling:	**Avoid continued contact with skin. Avoid contact with eyes.**

In any case of any exposure which elicits a response, a physician should be consulted immediately.

First Aid Procedures

Inhalation:	**Remove to fresh air. If not breathing give artificial respiration. In case of labored breathing give oxygen. Call a physician.**
Ingestion:	**No effects expected. Do not give anything to an unconscious person. Call a physician immediately.**
Skin Contact:	**Flush with plenty of water. Contaminated clothing may be washed or dry cleaned normally.**
Eye contact:	**Wash eyes with plenty of water for at least 15 minutes lifting both upper and lower lids. Call a physician.**

Section 7 - Reactivity Data

Conditions to Avoid:	**Strong oxidizing agents, bases and acids**
Hazardous Polymerization:	**None known**
Further Information:	**Hydrolyses in water to form Lactic Acid and Glycerol.**

Section 8 - Spill, Leak or Accident Procedures

After Spillage or Leakage:	**Neutralization is not required. This material may be burned in a chemical incinerator equipped with an afterburner and scrubber.**
Disposal:	**Laws and regulations for disposal vary widely by locality. Observe all applicable regulations and laws. This material, may be disposed of in solid waste. Material is readily degradable and hydrolyses in several hours.**

No requirement for a reportable quantity (CERCLA) of a spill is known.

Section 9 - Special Protection or Handling

Should be stored in plastic lined, steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass containers.

Protective Gloves:	**Vinyl or Rubber**
Eyes:	**Splash Goggles or Full Face Shield** **Area should have approved means of washing eyes.**
Ventilation:	**General exhaust.**
Storage:	**Store in cool, dry, ventilated area. Protect from incompatible materials.**

Section 10 - Other Information

This material will degrade in the environment by hydrolysis to lactic acid and glycerol. Materials containing reactive chemicals should be used only by personnel with appropriate chemical training.

The information contained in this document is the best available to the supplier as of the time of writing. Some possible hazards have been determined by analogy to similar classes of material. No separate tests have been performed on the toxicity of this material. The items in this document are subject to change and clarification as more information becomes available.

eXtended release formula Hydrogen Release Compound (HRC-X™)
MATERIAL SAFETY DATA SHEET (MSDS)

Last Revised: **March 24, 2004**

Section 1 - Material Identification

Supplier:

1011 Calle Sombra
San Clemente, CA 92673

Phone: **949.366.8000**

Fax: **949.366.8090**

E-mail: **info@regenesis.com**

Chemical Name:	**Propanoic acid, 2-[2-[2-(2-hydroxy-1-oxopropoxy)-1-oxopropoxy]-1-oxopropoxy]-1,2,3-propanetriyl ester**
Chemical Family:	**Organic Chemical**
Trade Name:	***eXtended release formula* Hydrogen Release Compound (HRC-X™), Glycerol tripolylactate and Glycerol**
Product Use:	**Used to remediate contaminated soil and groundwater (environmental applications)**

Section 2 – Chemical Identification

CAS#	Chemical
201167-72-8	Glycerol Tripolylactate
56-81-5	Glycerol
50-21-5	Lactic Acid

Section 3 - Physical Data

Melting Point:	**Not Available (NA)**
Boiling Point:	**Not Determined (ND)**
Flash Point:	**ND**
Density:	**1.3 g/cc**
Solubility:	**Acetone and DMSO**
Appearance:	**Viscous amber gel/liquid**
Odor:	**Not detectable**
Vapor Pressure:	**None**

Section 4 - Fire and Explosion Hazard Data

Extinguishing Media: **Carbon Dioxide, Dry Chemical Powder or Appropriate Foam.**

Water may be used to keep exposed containers cool.

For large quantities involved in a fire, one should wear full protective clothing and a NIOSH approved self contained breathing apparatus with full face piece operated in the pressure demand or positive pressure mode as for a situation where lack of oxygen and excess heat are present.

Section 5 - Toxicological Information

Acute Effects:	**May be harmful by inhalation, ingestion, or skin absorption. May cause irritation. To the best of our knowledge, the chemical, physical, and toxicological properties of the glycerol tripolylactate have not been investigated. Listed below are the toxicological information for glycerol and lactic acid.**
RTECS#:	**MA8050000** **Glycerol**

Section 5 - Toxicological Information (cont)

Irritation data:	**SKN-RBT 500 MG/24H MLD** **85JCAE-,207,1986** **EYE-RBT 126 MG MLD** **EYE-RBT 500 MG/24H MLD** **SKN-RBT 5MG/24H SEV** **EYE-RBT 750 UG SEV**	**BIOFX* 9-4/1970** **85JCAE-,207,1986** **85JCAE -,656,86** **AJOPAA 29,1363,46**
Toxicity data:	**ORL-MUS LD50:4090 MG/KG** **FRZKAP (6),56,1977** **SCU-RBT LD50:100 MG/KG** **ORL-RAT LD50:12600 MG/KG** **IHL-RATLC50:>570MG/M3/1HBIOFX*9-4/1970 IPR-RAT LD50: 4420 MG/KG** **IVN-RAT LD50: 5566 MG/KG** **SCU-MUS LD50: 91 MG/KG** **IPR-MUS LD50: 8700 MG/KG** **IVN-MUS LD50: 4250 MG/KG** **ORL-RBT LD50: 27 GM/KG** **SKN-RBT LD50:>10GM/KG** **IVN-RBT LD50: 53 GM/KG** **ORL-GPG LD50: 7750 MG/KG** **ORL-RAT LD50:3543 MG/KG** **SKN-RBT LD50:>2 GM/KG** **ORL-MUS LD50: 4875 MG/KG** **ORL-GPG LD50: 1810 MG/KG** **ORL-QAL LD50: >2250 MG/KG**	**NIIRDN 6,215,1982** **FEPRA7 4,142,1945** **RCOCB8 56,125,1987** **ARZNAD 26,1581,1976** **NIIRDN 6,215,1982** **ARZNAD 26,1579,1978** **JAPMA8 39,583,1950** **DMDJAP 31,276,1959** **BIOFX* 9-4/1970** **NIIRDN 6,215,1982** **JIHTAB 23,259,1941** **FMCHA2-,C252,91** **FMCHA2-,C252,91** **FAONAU 40,144,67** **JIHTAB 23,259,41** **FMCHA2-,C252,91**
Target Organ data:	**Behavioral (headache), gastrointestinal (nausea or vomiting), Paternal effects (spermatogenesis, testes, epididymis, sperm duct), effects of fertility (male fertility index, post-implantation mortality).**	
RTECS#:	**OD2800000** **Lactic acid**	

Only selected registry of toxic effects of chemical substances (RTECS) data is presented here. See actual entry in RTECS for complete information on lactic acid and glycerol.

Section 6 - Health Hazard Data

Handling:	**Avoid continued contact with skin. Avoid contact with eyes.**

In any case of any exposure which elicits a response, a physician should be consulted immediately.

First Aid Procedures

Inhalation:	**Remove to fresh air. If not breathing give artificial respiration. In case of labored breathing give oxygen. Call a physician.**
Ingestion:	**No effects expected. Do not give anything to an unconscious person. Call a physician immediately.**
Skin Contact:	**Flush with plenty of water. Contaminated clothing may be washed or dry cleaned normally.**
Eye contact:	**Wash eyes with plenty of water for at least 15 minutes lifting both upper and lower lids. Call a physician.**

Section 7 - Reactivity Data

Conditions to Avoid:	**Strong oxidizing agents, bases and acids**
Hazardous Polymerization:	**None known**
Further Information:	**Hydrolyses in water to form Lactic Acid and Glycerol.**

Section 8 - Spill, Leak or Accident Procedures

After Spillage or Leakage:	**Neutralization is not required. This material may be burned in a chemical incinerator equipped with an afterburner and scrubber.**
Disposal:	**Laws and regulations for disposal vary widely by locality. Observe all applicable regulations and laws. This material, may be disposed of in solid waste. Material is readily degradable and hydrolyses in several hours.**

No requirement for a reportable quantity (CERCLA) of a spill is known.

Section 9 - Special Protection or Handling

Should be stored in plastic lined steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass containers.

Protective Gloves:	**Vinyl or Rubber**
Eyes:	**Splash Goggles or Full Face Shield** **Area should have approved means of washing eyes.**
Ventilation:	**General exhaust.**
Storage:	**Store in cool, dry, ventilated area. Protect from incompatible materials.**

Section 10 - Other Information

This material will degrade in the environment by hydrolysis to lactic acid and glycerol.
Materials containing reactive chemicals should be used only by personnel with appropriate chemical training.

The information contained in this document is the best available to the supplier as of the time of writing. Some possible hazards have been determined by analogy to similar classes of material. No separate tests have been performed on the toxicity of this material. The items in this document are subject to change and clarification as more information becomes available.